FAA-E-2532
February 5, 1973

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION SPECIFICATION

MOBILE POWER PLANT, GAS TURBINE GENERATOR

1. SCOPE

1.1 Scope.- This specification sets forth the FAA requirements for mobile gas turbine generator power plants which will be utilized for emergency standby or continuous power service to electronic equipment, lighting, etc., in the National Airspace System.

2. APPLICABLE DOCUMENTS

2.1 FAA documents.- The following FAA specifications and standards, of the issue specified in the invitation for bids or request for proposals, form a part of this specification and are applicable to the extent specified herein.

2.1.1 FAA specifications

FAA-E-2533	Gas Turbine Generator Sets, 30 KW to 450 KW
FAA-E-2534	Trailer, Heavy Duty, for Mobile Gas Turbine Generator Sets

2.1.2 FAA standards

FAA-STD-003	Paint Systems for Structures

2.2 Federal standard.- The following Federal standard, of the issue in effect on the date of the invitation for bids or request for proposals, forms a part of this specification and is applicable to the extent specified herein.

Fed. STD 595 Colors

2.3 Military standard.- The following Military standard of the issue in effect on the date of the invitation for bids or request for proposals forms a part of this specification and is applicable to the extent specified herein.

MIL STD 705A Generator Sets, Engine-Driven Methods of Test and Instructions

2.4 Other publications.- The following publications of the issue in effect on the date of the invitation for bids or request for proposals form a part of this specification and are applicable to the extent specified herein.

American National Standards Institute (ANSI) Standard

S1.4 - 1961 Specification for General-Purpose Sound Level Meters

S3.6 - 1964 Specification for Audiometers

H 32.1 - 1967 Specification for Brass Wire

National Fire Protection Association (NFPA)

No. 70, National Electrical Code (NEC)

(Copies of this specification and other applicable FAA specifications and standards may be obtained from the Contracting Officer in the Federal Aviation Administration Office issuing the invitation for bids or request for proposals. Requests should fully identify material desired, i.e., specifications, standards and dates. Request should cite the invitation for bids, request for proposals, or the contract involved or other use to be made of the requested material.)

(Information on obtaining copies of the Federal standard may be obtained from General Services Administration offices in Atlanta; Auburn, Wash.; Boston; Chicago; Denver; Fort Worth; Kansas City, Mo.; Los Angeles; New Orleans; New York; San Francisco; and Washington, D.C.)

(Single copies of Military standards may be requested from U. S. Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120. Not more than five (5) items may be ordered on a single request; the contract schedule should be cited where applicable. Only latest revisions (complete with latest amendments) are available. Request all items by document number.)

(Information on obtaining copies of ANSI standards may be obtained from American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018.)

(Information on obtaining copies of the National Electrical Code may be obtained from National Fire Protection Association, 60 Batterymarch Street, Boston, Massachusetts 02110.)

3. REQUIREMENTS

3.1 Description.- The complete power plant shall consist of standard gas turbine generator set in accordance with Specification FAA-E-2533 mounted on a heavy-duty trailer in accordance with Specification FAA-E-2534. The entire power plant shall be complete with weatherproof housing, all electrical wiring, automatic transfer switch, fuel connections, intake-exhaust systems and any other ancillary equipment necessary to provide a fully operable mobile power plant capable of standby and continuous duty operation. The power plant shall be in general conformance with Figure 1. Locations and methods of installing the accessories may differ; however, all items specified hereinafter, or shown on the figure, must be included and shall be readily accessible for maintenance or replacement. This specification shall govern in case of conflicting requirements between this specification and other referenced specifications.

3.1.1 Gas turbine generator.- The gas turbine generator set shall be of class, size, and type per Specification FAA-E-2533, and shall have the rating, all as specified in the contract schedule.

3.1.2 Trailer.- The trailer shall be Size A or Size B, as required by the contract schedule, and shall conform to the requirements of Specification FAA-E-2534.

3.1.3 Accessories.- Mounting of the gas turbine generator on the trailer shall require the accessory items outlined below.

3.1.3.1 Enclosure.- The complete gas turbine generator set, exclusive of the exhaust silencer, shall be contained in a sheet metal housing completely enclosing the top, sides, and bottom, except for openings for drains, air

intake, and air exhaust. The enclosure shall be of 16 gauge steel or aluminum, constructed and sealed at all panels to prevent leakage of water into the enclosure during prolonged inclement weather service. The enclosure shall be sectionalized, reinforced with stiffeners as required to provide access to, and if necessary, replacement of any of the components of the gas turbine generator set without the removal of the complete housing. The side panels shall be removable and the end panel over the control cabinet shall be side hinged for the 30 KW and 60 KW sets and top hinged for the 175 KW set. This end panel, when top hinged and in the open position, shall serve as a weatherhood for the operator. The enclosure shall be treated to prevent corrosion including the effects of salt spray as could be expected from coastal environments. It shall protect the gas turbine generator set from rainfall and shall allow the set to operate continuously throughout the rating of the set per Specification FAA-E-2533, with three (3) inches of rain per hour impinging on the set at any angle between 15 degrees and 45 degrees from the vertical. A firewall shall be provided to separate the turbine and combustion section from the rest of the generator set, and thereby minimize heating of the air intake through radiation and recirculation of the hot air from the engine. The firewall partition may serve as a mounting surface for minor components of the set providing they are completely accessible with the side panels removed. The enclosure shall be provided with a ventilation fan, insulated air intake, and air intake filters. The air intake shall be sized to provide ventilation air and combustion air in sufficient quantity for the purpose intended. The enclosure shall be lined with a layer of fire retardant, sound attenuating material as specified in paragraph 3.1.3.3 of this specification. The floor of the enclosure shall have adequate drains so that any moisture entering unit when it is in operating status will be drained off without allowing any puddles to form. This paragraph supersedes paragraph 3.3.2 of Specification FAA-E-2533.

3.1.3.2 Intake and exhaust system.- Provisions shall be made for the turbine combustion and cooling air inlet and turbine exhaust systems as shown on Figure 1. An air inlet muffler and tank type floor standing exhaust silencer shall be provided and completely installed. Suitable flexible connections shall be provided. The silencer and connection to the exhaust at the unit shall be insulated or enclosed in such manner as to prevent accidental contact by personnel with hot surfaces. Where exposed to the weather, this insulation shall be covered with a weather-proof jacket. The stack of the silencer shall have a 1/4-inch drain with a gate valve placed in the bottom of the stack to prevent any accumulation of water in the silencer. All ventilation openings shall be covered with corrosion resistant screening having .125 x .125 inch mesh of .02-.03 inch diameter wire conforming to ANSI H 32.1. The screens shall be adequately supported to prevent sagging or bowing due to the movement of air through the screens when the turbine generator set is in operation. This paragraph supersedes paragraph 3.3.10 of Specification FAA-E-2533.

3.1.3.3 Insulating material.- Thermal and sound insulating materials shall be noncapillary; nonhygroscopic; free from percepticle odors; resistant to attacks by insects, rodents, mildew, and fungi; fire retardant; unaffected materially by battery electrolyte or petroleum derivatives; capable of maintaining its shape, position, and consistency (inherently or by suitable retaining methods) under conditions of vibration and the specified temperatures; resistant to or protected from abrasion; and paintable and bondable to metal. Sound insulation material shall not be painted.

3.1.3.4 Noise level.- Average noise levels emanating from the enclosed turbine generator set when it is operating at rated speed, no load and full load, shall not exceed the following values, when the microphone is located 5 feet - 8 inches above the ground on a 25-foot radius measured in any direction from the geometric center of the set.

Octave Band Center Frequencies CPS	Average Noise Level in Decibels at a Radius of 25 feet (0.0002 ubar reference)
63	91
125	81
250	73
500	70
1,000	69
2,000	68
4,000	67
8,000	66

3.1.4 Fuel lines.- Flexible fuel lines shall be installed between the trailer fuel tank and the gas turbine fuel system. The flexible fuel lines shall be certified by the manufacturer of these lines to be compatible with and not subject to injury or deterioration from the types of fuels to be used with the turbine generator sets. The fuel lines shall be installed so as to prevent kinks in or chafing of the lines.

3.1.4.1 Externally connected fuel lines.- Two fuel lines of the flexible type each twenty (20) feet in length, shall be provided with the gas turbine generator set to facilitate using fuel from any existing underground fuel tank at any of the various FAA facilities. One end of each of the fuel lines shall be compatible with the connections on the mobile power plant and the other end shall be furnished with the necessary fittings for either 3/8 inch flare type connections to existing copper tubing and for 1/2 inch NPT connections. Fittings to seal off the ends of these hoses when not in use shall be provided to prevent the entry of foreign matter or the leakage of any fuel left in the lines when the lines are not in use. Provisions shall be made for storing the fuel lines in the tool compartment on the trailer unit.

3.1.5 Automatic transfer equipment.- The standard gas turbine generator set procured under Specification FAA-E-2533 shall be provided with automatic transfer equipment. The automatic transfer equipment shall be mounted inside the gas turbine generator enclosure or the contractor may, at his option and as approved by the Contracting Officer, mount the automatic transfer equipment in a separate weatherproof cabinet securely mounted on the trailer in general conformance with Figure 1 of this specification. The automatic transfer equipment shall meet all requirements of paragraph 3.4.11 of Specification FAA-E-2533. All necessary electrical interconnections between the automatic transfer equipment and the gas turbine generator shall be in weatherproof enclosures or raceways and comply with the National Electrical Code. All terminal connections (power, control, and interlocks) shall be clearly identified, accessible, and oriented such that cables can be brought in from the bottom of the units without interference with any other components of the assembly. Connections shall be arranged such that all access panels of the mobile power plant can be closed during operating conditions.

3.1.6 Identification lamps.- The mobile power plant assembly, when mounted on the trailer, shall in addition to the lights and reflectors provided by paragraphs 3.15.1 and 3.15.2 of Specification FAA-E-2534 be provided with three identification lamps. The identification lamps shall be amber in color, and mounted on the vertical centerline of the vehicle as shown in Figure 1.

3.1.7 Locks.- The contractor shall provide locks for all access panels and padlocks for all compartments or enclosures furnished on the equipment. All locks shall be as manufactured by the Best Lock Company, P. O. Box 103, Indianapolis, Indiana. Locks shall meet the requirements listed below.

3.1.7.1 Type.- Type of locks shall be at the contractor's option, but must be compatible with the following.

3.1.7.2 Permanent cores.- Lock cores shall have seven pins, be removable, interchangeable and capable of being recombinated without the necessity of disassembling the entire core. Cores shall be identified by a code number on the side which will not be visible unless the core is removed from the locking mechanism. Cores shall be the dedicated "N" keyway type. Separate permanent lock cores shall be furnished for each lock on this equipment. These cores will be used and combinated by the Government offices located at the final destination point within the agency.

3.1.7.3 Construction core.- Each unit furnished under this specification shall have all locks (including padlocks) provided with construction cores keyed alike for the unit. Construction cores shall be "N" keyway type. Construction cores will be used as temporary core locks until such time as the agency distributed the units to the field. Two control keys shall be furnished for the construction cores for each piece of equipment procured under this specification.

3.1.8 Batteries.- Starting batteries of the lead acid type shall be furnished with each unit purchased under this specification. Battery starting voltage shall be minimum 24 volt suitable for the equipment furnished. Two or more batteries may be used to obtain the necessary starting voltage. Batteries shall be shipped dry charged with the electrolyte in separate nonbreakable containers. Batteries shall conform to the American Association of Battery Manufacturers Group 27F for 60 KW turbine generators and smaller and Group 8T for the 175 KW turbine generator. Batteries shall have a minimum watt-hour capacity at the 8-hour rate in accordance with Table I.

TABLE I

Size	KW	W-H @ 24 Volts	W-H @ 32 Volts	W-H @ 48 Volts
A	60	6,350	8,500	12,750
B	175	9,750	13,000	19,500

Flexible welding cables shall be furnished with proper connecting lugs to provide interconnections between cells, between batteries, and between the batteries and the starter motor. Cables and connectors shall be of sufficient capacity to carry the in-rush and running current of the starter motor. Batteries shall be placed in an accessible weatherproof enclosure that has provisions for gas venting and is fabricated from material that is corrosion and battery electrolyte resistant. The enclosure shall be constructed so that there is at least one inch clearance between the battery or cable terminals and any uninsulated part of the enclosure, cover, or components fastened to the enclosure. When the cover is in the open position, sufficient clearance shall be available to permit connections and disconnections of the battery cables using a standard wrench, and removal of the batteries from and reinstallation of the batteries in the enclosure without danger of shorting the batteries. The batteries shall be secured in the enclosure so that they cannot shift or move under the influences of vibration, transportation, or handling of the gas turbine generator set. Interior hold down bolts shall not be acceptable for this purpose; acid-resistant nonconductive blocks and brackets or means that will prevent transfer of heat to, or softening or charring of the battery cases shall be used. Drains having a minimum inside diameter of 5/16-inches shall be arranged in the enclosure so that any water or electrolyte spilled within the enclosure shall be directed to a formed low point in the bottom of the enclosure and through this drain to a place external to the power plant. Electric heaters shall be installed in such manner so as not to cause any interference with the servicing of the batteries nor cause any damage to the batteries or the enclosure. The heaters shall be thermost controlled and shall be capable of keeping the batteries at a temperature that will permit the turbine to start in 15 seconds at the conditions specified in paragraph 3.2.1 of Specification FAA-E-2533. The heater shall be protected by a circuit breaker. The heaters shall be operated at 115 volts AC and provisions shall be made for connection to an external 115 volt AC source when the mobile power plant is in a standby condition.

3.1.9 Electrical connections.- The mobile power plant shall be provided with the necessary interconnecting cables to mate the equipment with a standard FAA facility. The interconnecting cables shall consist of power, battery charger, and interlock cables as described below.

3.1.9.1 Power cables.- The contractor shall furnish all copper power cables necessary to connect the automatic transfer switch to the facility. Two sets of power cables will be required between the facility and the automatic transfer switch of the mobile power plant. The size and number of conductors required for the 30 KW, 60 KW and 175 KW classification referred to in Specification FAA-E-2534 shall be as follows:

Classification	AWG Size	No. of Conductor/Phase
A - 30 KW	1	1-C/Phase
A - 60 KW	1/0	1-C/Phase
B - 175 KW	3/0	2-C/Phase

Cable shall be 600 volt, extra-flexible single conductor stranded welding cable with neoprene jacket. When three phase, four wire units are called for in the contract, additional full size cable shall be provided for the neutral connection. Each cable furnished shall be thirty (30) feet in length. One end of the cable shall be compatible with terminals on the mobile power plant automatic transfer switch and the other end shall be suitable for connection to standard terminal lugs. The cables shall be stored in the compartment provided on the trailer units.

3.1.9.2 Battery charger cables.- Cables shall be provided for the purpose of maintaining the battery charged while the mobile power plant is stored and not in use. Cable shall be copper, three wire type with a male plug on one end suitable for plugging into a standard 120 volt AC ground receptacle. The other end of the cable shall be compatible with and connected to the battery charger system of the gas turbine generator unit. This end may be a fixed connection with crimp type connectors at the contractor's option. When not in use, the cable shall be stored in the compartment provided on the trailer unit. The cable shall be 40 feet in length.

3.1.9.3 Interlock cables.- Two copper conductors or one two-conductor cable #12 AWG, 600 volt rating, shall be provided to interlock with the FAA facility engine generator isolation switch, when the facility has an isolation switch. Cables shall be thirty (30) feet in length. The cables shall be wired to the generator side of the automatic transfer switch on the mobile power plant and the other ends shall be fitted with crimp type lug connectors. When not in use, the cable shall be stored in the compartment provided on the trailer unit.

3.1.10 Battery charger.- A battery charger similar to that specified in paragraph 3.4.8 of Specification FAA-E-2533 shall be furnished and installed on the power plant. The unit shall be mounted in the enclosure in such manner that it will be completely accessible when a side panel of the enclosure is opened or removed.

3.1.11 Convenience receptacle.- A duplex convenience receptacle shall be provided at a readily accessible place on the mobile power plant. The receptacle shall be rated 115 volts, 15 amperes, three wire grounded type and shall be protected by a 15 ampere circuit breaker. The receptacle shall be flush mounted and shall have a weatherproof plate with gasket. The plate shall have two covers, each on an independent hinge. The receptacle grounding terminal shall be connected to the power plant ground system through the power plant housing or base.

3.1.12 Grounding.- All noncurrent carrying parts of the electrical equipment on the mobile power plant, including the enclosure and trailer shall be grounded with an equipment grounding conductor. The grounding conductor shall be insulated green color coded or bare and shall be sized in accordance with Article 250 of the National Electrical Code. This grounding conductor shall be connected to a grounding terminal on the subbase of the gas turbine generator set. A terminal lug shall be mounted on the exterior of the subbase for connection to a grounding electrode. The work "GROUND" shall be stencilled adjacent to this terminal in conspicuous letters a minimum of one (1) inch high.

3.1.13 Surface finish.- Exterior surfaces of the assembly shall be finished in accordance with FAA-STD-003. Paint shall be Aviation Orange Color #12197 of Fed. Std. 595.

3.1.14 Drawings.- The contractor shall furnish one reproducible and three copies of the drawings specified in FAA-E-2533 and FAA-E-2534 in an integrated mobile power plant configuration. Drawings shall also show all electrical and mechanical connections necessary to integrate this equipment with an FAA facility.

3.1.15 Instruction book.- Two approved instruction books shall be shipped with each plant. Additional quantities shall be as specified in the contract schedule. The document shall be organized in an integrated mobile power plant configuration. Contents shall be as specified in FAA-E-2533 and FAA-E-2534.

4. QUALITY ASSURANCE PROVISIONS

4.1 Inspection and test procedures.- The contractor shall make available, without cost to the Government, complete facilities, including labor and material, necessary to perform the tests specified herein. Each mobile power plant shall be inspected at the contractor's plant. Turbine generator sets shall be or have been inspected in accordance with Section 4 of FAA-E-2533.

4.1.1 Tests.- After the gas turbine generator set has been mounted on the trailer to form the complete mobile power plant configuration called out in this specification, the units procured under this specification shall successfully pass the tests outlined herein. Tests shall be conducted with the units operating as indicated.

4.1.1.1 Rain test.- Each mobile power plant shall successfully pass a rain test as outlined in Method 711.3 of Military Standard MIL-STD-705A. Failure to pass the test shall require that the contractor modify the equipment until it can successfully pass the subject test. Any change in design shall be made to all mobile power plants being furnished under this procurement, subject to approval of any changes by the Contracting Officer. Improper drainage of water from the enclosure or derogation of performance as a result of water entering the enclosure shall constitute a failure.

4.1.1.2 Noise level test.- One mobile power plant of each size called for in the contract schedule shall be tested in a free field environment for noise level in accordance with paragraph 3.1.3.4. Instruments used in this sound level test shall conform to ANSI S 1.4 and S 3.6. Failure to pass this test shall require the contractor to modify the insulation used and retest the unit until the sound levels required are met. Any change to the type or thickness of the insulation must be approved by the Contracting Officer. Approved changes shall be made in all the units being furnished under this procurement.

5. PREPARATION FOR DELIVERY

5.1 General.- The mobile power plant shall be prepared for delivery in accordance with paragraph 5 of both, FAA-E-2533 and FAA-E-2534.

6. NOTES

6.1 Note on information items.- The contents of Section 6 are only for the information of the initiator of the procurement request and are not a part of the requirements of this specification. They are not contract requirements nor binding on either the Government or the contractor. In order for these terms to become a part of the resulting contract, they must be specifically incorporated in the schedule of the contract. Any reliance placed by the contractor on the information in these subparagraphs is wholly at his own risk.

6.2 Ordering data.- Procurement documents should specify:

(a) Title, number and date of this specification.

(b) Number of mobile power plants required.

(c) Title, style, and class of gas turbine generator sets to be used in the mobile power plants (3.1.1).

(d) Size of trailers for the mobile power plants (3.1.2).

(e) Specify KW rating, power factor, phase, frequency, voltage for the mobile power plants (3.1.1).

(f) Quantity of additional instruction books or temporary instruction books to be furnished and shipped to allow time for printing of the official instruction books.

(g) Serial numbers to be provided at time of contract award.

For Figure 1, See Page **12**

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NOTE:
TANDEM WHEELS AND FENDERS REQUIRED WITH 175 KW MOBILE UNITS

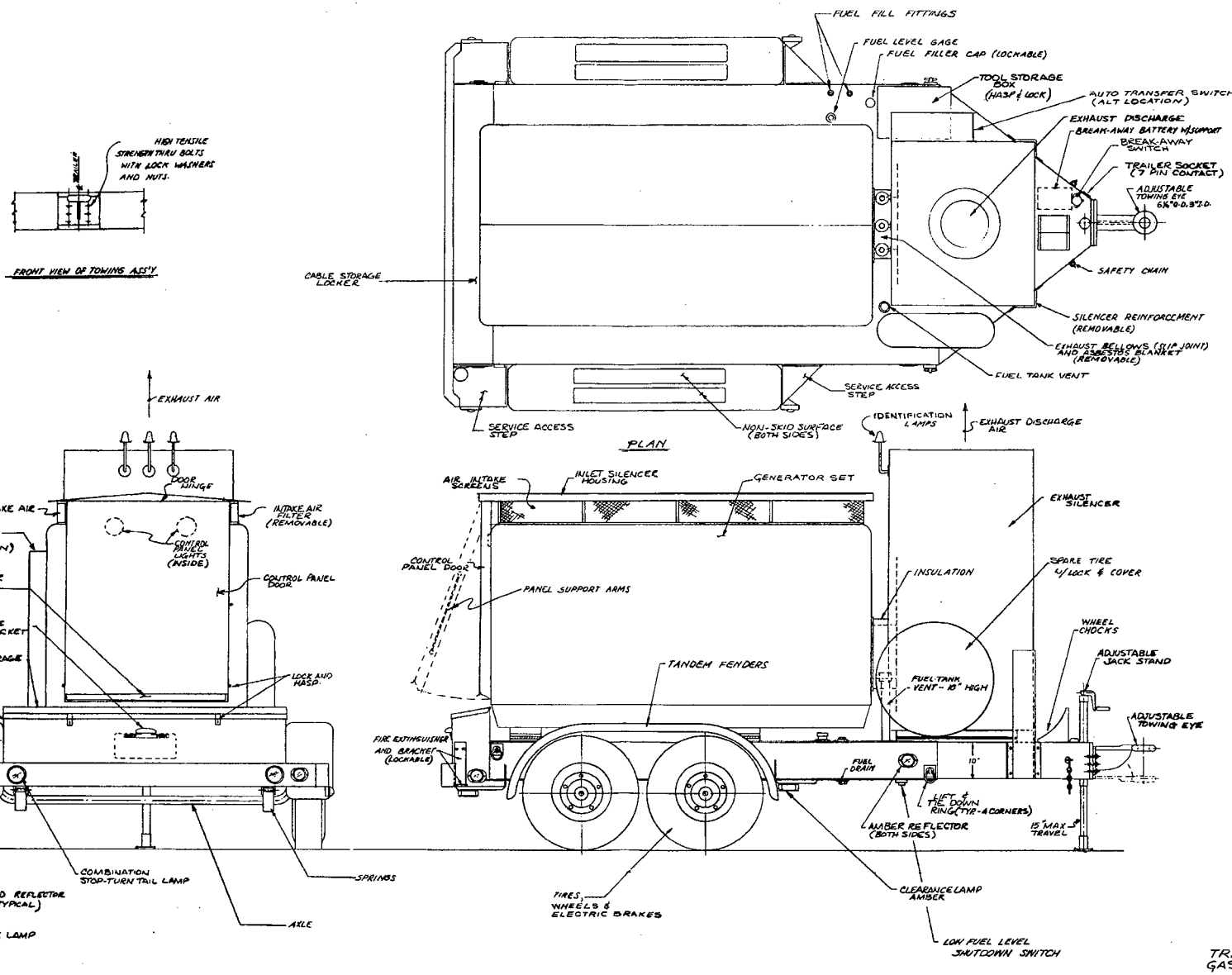

FIGURE 1
TRAILER MOUNTED MOBILE
GAS TURBINE GENERATOR

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